disease prevention news

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The Specter of Chemical and Biological Terrorism

Terrorism, as defined by the Federal Bureau of Investigation (FBI), is the "unlawful use of force against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in the furtherance of political or social objectives."[1] Terrorism has occurred in the US recently with the New York World Trade Center bombing (1993) and the Alfred P. Murrah Federal Building bombing in Oklahoma City (1995). The 1995 nerve gas attack in the Tokyo subway by the Aum Shinrikyo, a religious cult, added a new and frightening dimension to growing concern about terrorism —the use of chemical or biological weapons as agents of mass destruction.

By definition, chemical and biological terrorism employs harmful chemicals, pathogenic microbes, or plant or microbial toxins. Among the myriad chemicals and microbes from which to choose, only a few dozen, easy to manufacture agents are likely candidates.

Fortunately, although the preferred agents are easy to manufacture, dissemination to achieve maximum exposure and injury or illness is complex. For example, prior to the 1995 attack in Tokyo, the Aum Shinrikyo had made at least four unsuccessful attempts to disseminate biological or chemical weapons: botulinum toxin from a car exhaust in 1990 and 1993, anthrax spores from a sprayer system in 1993, and nerve gas (sarin) in 1994.[3] Even in the 1995 Tokyo attack, there were fewer victims than intended. Impurities in the nerve agent and poor dissemination reduced the impact of this attack.

Chemical Weapons

The following chemical agents are the most likely to be used in a terrorist attack.[2]

Nerve agents (sarin, VX) are considered the most toxic of all the military agents. Members of the organophosphate family of compounds, these agents can cause sudden loss of consciousness, seizures, respiratory distress, and death. Like related pesticides, nerve agents bind irreversibly to acetylcholinesterase, resulting in overstimulation of the end organ and leading to muscarinic effects (miosis, increased salivation), nicotinic effects (twitching, muscle weakness), central nervous system effects (nervousness, fatigue, seizures), and cardiac effects (arrhythmias, heart block). Patients should be decontaminated with 0.5% hypochlorite (a 1:10 dilution of household bleach) or large amounts of water. Treat with atropine/oximes.

Vesicants (sulfur mustard, Lewisite) cause skin blistering and severely damage the cornea and lungs. Sometimes known as as blister agents, they are rapidly absorbed through the skin, lungs, and eyes, where they irreversibly bind with tissue. Mustard is a strong DNA alkylating agent; even a small amount destroys the cells of tissue it contacts. Painful blisters form within 48 hours, and catastrophic tissue damage can occur in the eyes and lungs within a week. Exposed patients should be decontaminated/treated with hypochlorite or large amounts of water.

Cyanide is widely used in industry and has been used militarily in the last century. It has an odor of bitter almonds. Formerly known as a "blood agent," small amounts of cyanide interfere with essential aerobic energy pathways and lead to cellular death. At high inhalation exposures, rapid loss of consciousness, seizures, and cessation of breathing occur. Patients should be decontaminated with water and treated with supportive care.

Phosgene, also widely used in industry, is a pulmonary agent that has an odor of new-mown hay or freshly cut grass or corn. Slower-acting than other chemicals (latent period 6 to 8 hours), phosgene enters the

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lungs and is absorbed slowly over the next 24 hours. Alveolar capillary surfaces are attacked, and great volumes of fluid (serum) leak into the tissues. The exposed individual develops life-threatening, noncardiogenic pulmonary edema. Patients should treated with supportive care after decontamination with fresh air and copious water irrigation.

Riot control agents include tear gas, mace, and pepper sprays. This class of compounds causes involuntary eye closing, skin irritation, and/or airway irritation. These effects rarely last longer than an hour. Patients should be decontaminated with water; medical attention is generally not required.

...large geographic areas might need to be off-limits for cleanup/ decontamination.

Biological Weapons

In the US, the single documented instance of biological terrorism occurred in a small Oregon town in 1984.[3] Members of a religious cult, the Rajneeshee, obtained and maintained a supply of *Salmonella typhimurium* in an attempt to influence the outcome of a local election. They used these bacteria to intentionally contaminate salad bars in 10 area restaurants and water given to two county commissioners. More than 750 people, including the commissioners, became ill.

Authorities must be prepared for a false alarm or a fake release.

The agents of anthrax, plague, cholera, Q fever, tularemia, smallpox, Venezuelan equine encephalitis, and viral hemorrhagic fevers—as well as botulinum toxin, staphylococcal enterotoxin B, T2 mycotoxin, and ricin—have been studied for use in biological warfare. (See pages 4-5.) Characteristics that make these organisms good biowarfare candidates also make them attractive to terrorists. These organisms are

- readily available or easy to produce in large quantities
- highly virulent
- likely to affect only the unsuspecting populace, not the terrorists
- able to withstand harsh environmental conditions
- easy to distribute with proper technology
- easy to produce in a suitable particle size

A current technologic constraint to the use of biological agents is the difficulty of generating the correct size particle (1 to 5 microns in diameter). At this size, particles can be distributed over long distances, remain suspended for long periods of time, and penetrate the alveolar sacs in the lungs. Upon release, larger particles would fall to the ground immediately and never reach the alveolar air spaces to infect the lungs. This constraint may be overcome in the near future.

Scenarios

Chemical Agents. A terrorist event involving the release of a chemical agent would be similar to the 1995 sarin attack in Tokyo. The impact of the release would be obvious within seconds to minutes, with mass panic as individuals became ill, unconscious, or fatally injured. Police, fire, and emergency medical personnel, using appropriate personal protective equipment (eg, self-contained breathing apparatus, air purifying respiratory protection, and protective clothing), would be the first responders. "Hot zones" would have to be established for affected persons to prevent ambulances (or other transport vehicles) and hospital emergency departments from being contaminated. Final decontamination would have to be done before patients could be admitted to the hospital.

Biological Agents. An intentional, covert release of a biological agent would manifest itself differently. It might be days after a biological attack before exposed individuals would become ill and seek medical care. If an exotic biological agent were used, doctors would need additional time to suspect, confirm, and report the diagnosis to health authorities. The first indicator would probably be an increase in reported cases or deaths due to a specific infectious disease several days or weeks after the release (Table 1). In the meantime, more people could become infected. An initial

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"emergency response" would not occur, but action would be required. Determining whom to treat, where and when the exposure occurred, and which infection control measures to use would be of paramount importance. Exposed persons (including emergency staff) could need isolation, and disposing of bodies could be problematic.

In both types of situations, large geographic areas might need to be off-limits for cleanup/decontamination. Determining when a building or area is safe for reentry would likely be difficult. Extraordinary resources, organization, and a coordinated response would be essential for an adequate emergency and medical response to even a moderate release.

Authorities must also be prepared for a false alarm or a fake release. Panic and confusion is inevitable. A great number of "unexposed, but worried well" would flood the emergency medical system, diverting limited resources away from those who truly need medical attention.

Table 1. Clues to a Biologic Attack

- The epidemic is large, appearing to be a massive point source outbreak. The number of ill and dying is unprecedented.
- The number of respiratory manifestations (signature of aerosol route of exposure), number of severe cases, and death rate is higher than usual.
- The epidemiology is incorrect (ie, nonendemic agents for a given geographic area; the mode of transmission appears to be inappropriate [eg, tularemia without tick bites or exposure to animal tissues]).
- There are multiple simultaneous outbreaks or multiple agents in single patients at same site.
- The causative agent is a multiresistant pathogen never before isolated.
- Large numbers of animals are dead or dying.
- There is evidence/identification of delivery vehicles.
- Terrorists claim responsibility or publicize the attack during the incubation period to create panic.

Recent Federal Legislation

There has been growing concern about the nation's inability to adequately respond to biological or chemical terrorism.[4,5] In June 1995 the **United States Policy on Counterterrorism [Presidential Decision Directive 39 (PDD-39)]** was signed, which defines broad responsibilities and coordinates relationships among federal agencies. At the federal level, the FBI and Federal Emergency Management Agency are responsible for crisis management and consequence management, respectively. Other federal agencies have been appointed to provide operational support as needed.

The **Antiterrorism and Effective Death Penalty Act of 1996** amends the **Chemical and Biological Weapons Control Act of 1991**, expanding the federal government's authority to address individuals or groups who threaten or attempt to develop biological weapons, including those created by recombinant technology. The Act also directs CDC to establish a list of biological agents of potential danger to public health and to regulate the transfer and use of these agents.

The **Defense Against Weapons of Mass Destruction Act of 1996** was enacted to improve federal and local response capabilities. Moreover, an amendment (often cited as the **Nunn-Lugar-Domenici Amendment**) to the **Defense Authorization Act of 1997** authorizes $100 million to establish a rapid response capacity in the military, to implement assistance and training at the state and local emergency response level, and to establish "medical management strike teams" in 100 cities in the nation. The military is now authorized to assist local and state governments in responding to an attack; military "response teams" can bring in special resources and assist with decontamination. Although improvements are underway, our capability to respond effectively to biological or chemical releases at this time is far less than needed.

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Biological Agents That May

Organism	Disease	Incubation	Signs/symptoms
Bacillus anthracis	respiratory anthrax	1-6 days	fever, malaise, fatigue, cough, mild chest pain followed by quick onset of severe respiratory distress. Shock and death follow within 24-36 hours.
Yersinia pestis	pneumonic plague	2-3 days	high fever, chills, headache, hemoptysis, toxemia. Death results from respiratory failure and circulatory collapse.
Coxiella burnetii	Q fever	usually 2-3 weeks	fever, chills, cough, headache, weakness, chest pain
Francisella tularensis	typhoidal tularemia	2-10 days	fever, headache, malaise, substernal discomfort, prostration
Vibrio cholerae	cholera	12-72 hours	sudden onset of vomiting and abdominal distension followed by watery diarrhea
Variola virus	smallpox	average of 12 days	malaise, fever, rigors, headache and backache followed by defervescence and typical skin eruption (macules to papules to vesicles to pustules over 7-10 days). Fever may reappear 7 days after onset of rash. There is a 35% fatality rate.
Alphavirus	Venezuelan equine encephalitis	1-5 days	fever, malaise, severe headache, rigors, photophobia, myalgias, cough, sore throat, vomiting
RNA viruses	viral hemorrhagic fevers	varies	fever, myalgia, prostration. Evolves to shock and generalized mucous membrane hemorrhage.
Botulinum toxin	inhalation botulism	24 hours - several days	bulbar palsies with blurred vision, dysarthria, dysphonia, dysphagia followed by skeletal muscle paralysis, progressive symmetrical descending weaknes, and respiratory failure
Staphylococcal enterotoxin B	staphylococcal enterotoxin B intoxification	3-12 hours	sudden onset of fever, chills, headache, myalgia, nonproductive cough; dyspnea and retrosternal chest pain in more severe cases
Trichothecene mycotoxins (T2)	T2 mycotoxin intoxification	minutes to hours	skin and mucous membrane inflammation. Severe poisoning results in prostration, weakness, ataxia, collapse, shock, and death.
Ricin	ricin intoxification	4-8 hours	fever, cough, dyspnea, nausea, chest tightness, and arthralgias followed by sweating, pulmonary edema, cyanosis, and ultimately respiratory failure and circulatory collapse; death in 36-72 hours

Be Used By Terrorists

Diagnostic tests		Treatment	Prophylaxis
Rapid	**Other**		
large Gram positive rods on Gram stain	culture of organism from blood, sputum, CSF, other fluids/tissues; serologic testing of paired sera drawn in red top tubes	oral ciprofloxacin, 1000 mg initially, then 750 mg po bid; IV doxycycline, 200 mg initially, then 100 mg q 12 hours	ciprofloxacin, 500 mg po bid; doxycycline, 100 mg po bid
Gram negative, pleomorphic rods on Gram stain; fluorescent stain	culture of lymph node aspirates, sputum, or blood	streptomycin, 30 mg/kg/day in 2 divided doses x 10 days; IV doxycycline, 200 mg initially, then 100 mg every 12 hours for 10-14 days	doxycycline, 100 mg bid for 7 days or duration of risk
	serologic testing of paired sera drawn in red top tubes	oral tetracycline, 500 mg every 6 hrs; doxycycline, 100 mg every 12 hrs for 5-7 days	Prophylaxis must be timed properly: start 8-12 days postexposure and continue 5 days.
fluorescent stain of exudate, sputum, or other specimens	serologic testing of paired sera drawn in red top tubes	streptomycin, 1 gm every 12 hours IM for 10-14 days	Use of antibiotics is controversial; some recommend tetracycline.
visualization by darkfield microscopy of motile organisms in fresh watery stool	culture of organism from stool or rectal swab	fluid and electrolyte replacement. Tetracycline, ampicillin, and trimethoprim sulfamethoxazole shorten duration of illness.	
		Vaccinia-immune globulin may be of value if given early.	
	isolation of virus from blood, demonstration of specific IgM antibody in serum or CSF, serologic testing of paired sera drawn in red top tubes	supportive care	
	specific virologic and serologic assays	intensive supportive care	
	isolation of organism or demonstration of toxin in serum	intubation and ventilatory assistance	
	serologic testing of paired sera drawn in red top tubes	supportive care	
		soap and water, supportive care	
	serologic testing of paired sera drawn in red top tubes	supportive care	protective mask

Longstanding Texas Legislation

The Texas Department of Health (TDH) needs no new legislation to respond to biological or chemical terrorism. The authority to investigate and control communicable diseases is found in the **Communicable Disease Prevention and Control Act, Texas Health and Safety Code Chapter 81**. Chapter 81 allows TDH to take emergency measures (such as quarantine and mass immunizations) when communicable disease poses a public health threat. The Department is also authorized to conduct epidemiologic and toxicologic investigations of conditions and environmental exposures that are harmful or believed to be harmful (**Health and Safety Code Chapter 161.0211**).

In 1997 the FBI opened 900 credible domestic terrorism cases....

The Threat

Whether the terrorist group is political (foreign government-supported), social (domestic, interested in governmental change), or religious, may influence what kind of weapon it chooses. Religious cults have been responsible for the three most recent chemical or biological attacks. These groups are the Rajneeshee in Oregon, the Aum Shinrikyo in Tokyo, and Islamic terrorists at the World Trade Center. (The World Trade Center bomb also packed cyanide in the charge. Fortunately, the explosion evaporated the chemical agent.)

Serious, immediate planning is of paramount importance.

The Aum Shinrikyo may have broken what analysts have suggested was a longstanding "taboo" against chemical or biological terrorism.[6,7] In 1997 the FBI opened 900 credible domestic terrorism cases—800 more than in 1995.[8] It is likely that these cases comprised all forms of domestic terrorism, including those in which biological or chemical agents were involved. Authorities have also discovered plans for the use of biological agents and, in some cases, have recovered toxins or pathogenic microbes.[9]

Also in 1997, the FBI conducted 50 different investigations of individuals or groups suspected of using/planning to use radiological, biological, or chemical agents.[9] On February 19, 1998, they arrested two men near Las Vegas for possible possession of *Bacillus anthracis*. While the confiscated material was found not to be hazardous, the threat in the US gained national attention.

Unless the threat of biological terrorism is met with proper preparation and vigilance, hundreds, or even thousands of people could be injured or killed. Serious, immediate planning is of paramount importance. Areas to address are responder training, communication links, pre-incident intelligence, environmental monitoring, safe and effective patient removal and decontamination, mass-casualty triage, public health surveillance, medical education, rapid laboratory confirmation, treatment/antidotes availability, prevention, and assessment and treatment of psychological effects.

Prepared by Dennis Perrotta, PhD, Chief, Bureau of Epidemiology; Julie Rawlings, MPH, Infectious Disease Epidemiology and Surveillance (IDEAS); and Marci Eckman, student intern, IDEAS.

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Diseases in Nature Conference Includes Bioterrorism Presentation

The Texas A&M University College of Veterinary Medicine and the Zoonosis Control Division of the Texas Department of Health are pleased to announce the 48th Annual Southwest Conference on Diseases in Nature Transmissible to Man. The conference is being held at the Hilton Hotel in College Station on June 3-4, 1998.

Featured speakers include experts from the Texas Animal Health Commission, the Texas Department of Health, the Centers for Disease Control and Prevention, other state and local health departments, and several universities. Subjects to be discussed this year include anthrax, rabies, molecular epidemiology, zoonotic disease vectors, Creutzfeldt-Jacob Disease, plague, cysticercosis, and cryptosporidiosis. The speaker for the JV Irons Luncheon is Dr. David L. Huxsoll, Dean of the School of Veterinary Medicine, Louisiana State University. Dr. Huxsoll's presentation is titled, "Biological Warfare: An Old Problem with New Concerns."

Texas A&M University is accrediting the program with continuing education units. The State Board of Veterinary Medical Examiners has been petitioned to honor the University's continuing education units relative to specific professionals and relicensure requirements. Past conferences have qualified for 10 to 15 hours of CEU credits. The Texas Veterinary Medical Association and the Texas Animal Control Association have approved 10.5 CEU hours for Registered Veterinary Technicians and Animal Control Officers respectively.

For further information and registration materials, contact Jim Schuermann, Zoonosis Control Division, Texas Department of Health at (512) 458-7255, EMAIL: **jim.schuermann@tdh.state.tx.us**.

Reporting of Occupational Conditions

On February 8, 1998, the Texas Department of Health adopted an amendment to the to the Texas Administrative Code, Chapter 99, to lower the level of adult blood lead that must be reported from ≥40 micrograms of lead per deciliter of blood to **≥25 µg/dL** of blood in adults 15 years of age and older. This lower reporting level became effective March 1, 1998.

Questions concerning this change should be directed to Diana Salzman, TDH Adult Blood Lead Surveillance and Epidemiology Coordinator at 800/588-1248 or 512/458-7269.

Disease Prevention News (DPN)
Texas Department of Health
1100 West 49th Street
Austin, TX 78756-3199
Phone: 512-458-7677
Fax: 512-458-7616
Internet: dpn@discon.tdh.state.tx.us

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http://www.tdh.state.tx.us/phpep/dpnhome.htm
TDH Healthy Texans BBS: (800) 858-5833

Errata in DPN Vol. 58, No. 5: Change in HRIG Administration Recommendation

Several phrases were missing from the text, which should have read as follows:

Rabies postexposure prophylaxis (PEP) for persons not previously vaccinated includes administration of both rabies vaccine and human rabies immune globulin (HRIG). In the new recommendation from the Advisory Committee for Immunization Practices (ACIP), the HRIG dosage remains the same at 20 IU/kg. However, the manner in which the HRIG is adminstered has changed to the following: "...as much as possible of the full dose of HRIG should be thoroughly infiltrated into and around the wound(s). Any remaining volume should be administered intramuscularly at a site distant from the vaccine inoculation." (CDC. Human Rabies—Texas and New Jersey, 1997. MMWR. 1998;47:1-4)

Detailed information on the evaluation of a possible rabies exposure and the treatment of such exposures in Texas is available at the Texas Department of Health Internet home page.
See *Rabies Prevention in Texas* at **http://www.tdh.state.tx.us/rabies/rabies97.htm**.